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What is Claimed:

- 1                   1.       A semiconductor device comprising:  
  
2                   a substrate having a first thermal expansion coefficient; and  
  
3                   an organic semiconductor material coupled to the substrate at an interface  
4                   therebetween, the organic semiconductor material having a second thermal expansion  
5                   coefficient that is different from the first thermal expansion coefficient, whereby a  
6                   mechanical stress is transferred from the substrate to the organic semiconductor material  
7                   through the interface, the mechanical stress being related to the difference between the  
8                   first thermal expansion coefficient and the second thermal expansion coefficient.
- 1                   2.       The semiconductor device of claim 1 wherein the mechanical stress is  
2                   a compressive stress transferred from the substrate to the organic semiconductor material  
3                   through the interface.
- 1                   3.       The semiconductor device of claim 2 wherein the compressive stress  
2                   decreases a distance between adjacent molecules in the organic semiconductor material,  
3                   thereby increasing carrier mobility of the organic semiconductor material.
- 1                   4.       The semiconductor device of claim 1 wherein the mechanical stress is  
2                   a tensile stress transferred from the substrate to the organic semiconductor material  
3                   through the interface.
- 1                   5.       The semiconductor device of claim 4 wherein the tensile stress  
2                   increases a distance between adjacent molecules in the organic semiconductor material,  
3                   thereby decreasing carrier mobility of the organic semiconductor material.
- 1                   6.       A method of fabricating a semiconductor device comprising:  
  
2                   providing a substrate having a first thermal expansion coefficient;

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3 coupling an organic semiconductor material to the substrate at an interface  
4 therebetween, the organic semiconductor material having a second thermal expansion  
5 coefficient different from the first thermal expansion coefficient; and

6 applying a mechanical stress to the organic semiconductor material through  
7 the interface by varying a temperature of the substrate such that the substrate changes in  
8 at least one physical dimension.

1 7. The method of claim 6 wherein the applying step includes applying a  
2 compressive stress to the organic semiconductor material through the interface.

1 8. The method of claim 7 further comprising the step of decreasing a  
2 distance between adjacent molecules in the organic semiconductor material, thereby  
3 increasing carrier mobility of the organic semiconductor material.

1 9. The method of claim 6 wherein the applying step includes applying a  
2 tensile stress to the organic semiconductor material through the interface.

1 10. The method of claim 9 further comprising the step of increasing a  
2 distance between adjacent molecules in the organic semiconductor material, thereby  
3 decreasing carrier mobility of the organic semiconductor material.

1 11. A semiconductor device comprising:

2 a substrate;

3 an organic semiconductor material coupled to the substrate at an interface  
4 therebetween; and

5 an actuator provided for use with at least one of the substrate or the organic  
6 semiconductor, the actuator being selected from the group comprising piezoelectric  
7 actuators, piezomagnetic actuators, electrostrictive actuators, magnetostrictive actuators,  
8 electrostatic actuators, magnetostatic actuators, shape memory alloy actuators, magnetic  
9 shape memory alloy actuators, and electroactive polymer actuators, the actuator applying

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10 a mechanical force to at least one of the substrate or the organic semiconductor upon the  
11 actuator being actuated, the mechanical force varying a carrier mobility of the organic  
12 semiconductor.

1 12. The semiconductor device of claim 11 wherein the mechanical force is  
2 a compressive stress, the compressive stress decreasing a distance between adjacent  
3 molecules in the organic semiconductor material, thereby increasing carrier mobility of the  
4 organic semiconductor material.

1 13. The semiconductor device of claim 11 wherein the mechanical force is  
2 a tensile stress, the tensile stress increasing a distance between adjacent molecules in the  
3 organic semiconductor material, thereby decreasing carrier mobility of the organic  
4 semiconductor material.

1 14. The semiconductor device of claim 11 wherein the actuator is  
2 integrated into at least one of the substrate or the organic semiconductor material.

1 15. A method of fabricating a semiconductor device comprising:

2 providing an organic semiconductor material coupled to a substrate;

3 providing an actuator for use with at least one of the substrate or the  
4 organic semiconductor material, the actuator being selected from the group comprising  
5 piezoelectric actuators, piezomagnetic actuators, electrostrictive actuators,  
6 magnetostrictive actuators, electrostatic actuators, magnetostatic actuators, shape  
7 memory alloy actuators, magnetic shape memory alloy actuators, and electroactive  
8 polymer actuators; and

9 applying a mechanical force to at least one of the substrate or the organic  
10 semiconductor material by actuating the actuator, the mechanical force varying a carrier  
11 mobility of the organic semiconductor material.

1 16. The method of claim 15 wherein said applying step includes applying  
2 a compressive stress to at least one of the substrate or the organic semiconductor material

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3 by actuating the actuator, the compressive stress decreasing a distance between adjacent  
4 molecules in the organic semiconductor material, thereby increasing carrier mobility of the  
5 organic semiconductor material.

1 17. The method of claim 15 wherein said applying step includes applying  
2 a tensile stress to at least one of the substrate or the organic semiconductor material by  
3 actuating the actuator, the tensile stress increasing a distance between adjacent molecules  
4 in the organic semiconductor material, thereby decreasing carrier mobility of the organic  
5 semiconductor material.

1 18. The method of claim 15 wherein said coupling step includes  
2 integrating the actuator into at least one of the substrate or the organic semiconductor  
3 material.

1 19. A semiconductor device comprising:

2 a semiconductor package; and

3 an organic semiconductor material provided within the semiconductor  
4 package, the semiconductor package having a hydrostatic pressure applied thereto such  
5 that the pressure within the semiconductor package is different from atmospheric  
6 pressure, the applied hydrostatic pressure varying carrier mobility of the organic  
7 semiconductor material.

1 20. The semiconductor device of claim 19 wherein the hydrostatic  
2 pressure applies a compressive stress to the organic semiconductor material, the  
3 compressive stress decreasing a distance between adjacent molecules in the organic  
4 semiconductor material, thereby increasing carrier mobility of the organic semiconductor  
5 material.

1 21. The semiconductor device of claim 19 wherein the hydrostatic  
2 pressure applies a tensile stress to the organic semiconductor material, the tensile stress  
3 increasing a distance between adjacent molecules in the organic semiconductor material,  
4 thereby decreasing carrier mobility of the organic semiconductor material.

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1                   22.     The semiconductor device of claim 19 wherein the hydrostatic  
2     pressure is provided by at least one of gaseous pressure, liquid pressure, gel pressure,  
3     solid pressure, or a combination thereof.

1                   23.     A method of fabricating a semiconductor device comprising:  
  
2                   providing an organic semiconductor material in a semiconductor package;  
3     and

4                   applying a hydrostatic pressure to the semiconductor package such that the  
5     pressure within the semiconductor package is different from atmospheric pressure, the  
6     applied hydrostatic pressure varying carrier mobility of the organic semiconductor  
7     material.

1                   24.     The method of claim 23 wherein said applying step includes applying,  
2     through the hydrostatic pressure, a compressive stress to the organic semiconductor  
3     material, the compressive stress decreasing a distance between adjacent molecules in the  
4     organic semiconductor material, thereby increasing carrier mobility of the organic  
5     semiconductor material.

1                   25.     The method of claim 23 wherein said applying step includes applying,  
2     through the hydrostatic pressure, a tensile stress to the organic semiconductor material,  
3     the tensile stress increasing a distance between adjacent molecules in the organic  
4     semiconductor material, thereby decreasing carrier mobility of the organic semiconductor  
5     material.

1                   26.     The method of claim 23 wherein said applying step includes applying  
2     at least one of gaseous pressure, liquid pressure, gel pressure, solid pressure, or a  
3     combination thereof into the semiconductor package.